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CASE REPORT

Endovascular Stent for Coarctation of the Aorta in a Child and Review of the Literature

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An 11-year-old, 35-kg boy underwent balloon angioplasty twice, at the ages of 4 years and 10 years, with only limited effect. He was admitted for another cardiac catheterization because of chest pain and breathlessness on exercise. Aortography revealed severe discrete coarctation of the aorta, with the narrowest diameter of 6 mm. The pressures of the ascending aorta and descending aorta were 115/72 mmHg and 93/66 mmHg, respectively. After implantation of a 16-mm-diameter stent, the systolic pressure gradient decreased from 22 mmHg to 0 mmHg. Annual follow-up for 6 years showed normal blood pressure, no exercise intolerance, and no recoarctation.

1. Introduction

The coarctation of the aorta represents about 6—8% of all congenital cardiac anomalies and is the fourth most common lesion requiring surgical or catheter intervention during infancy.[1] Treatment options include surgery, balloon angioplasty, and endovascular stenting. Nowadays, nonsurgical treatment has become more and more popular, but the effect of balloon angioplasty is limited. Endovascular stenting has been developed for two decades but is still controversial for growing children.[2] Here, we report an 11-year-old boy with coarctation of the aorta who was successfully treated with stent implantation and also review the updated literature.

2. Case Report

This 11-year-old, 35-kg boy was found to have coarctation of the aorta in early childhood by echocardiography because of heart murmur. He underwent balloon angioplasty twice, at the ages of 4 years and 10 years, with only limited effect. He was admitted for another cardiac catheterization because of chest pain and breathlessness on exercise. Physical examination showed Grade 2/6 systolic

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murmur over the upper right sternal border and the interscapular region. The blood pressures of the right arm and right leg, measured by an oscillometric cuff, were 125/88 mmHg and 112/62 mmHg, respectively. In the catheterization room, aortography revealed severe discrete coarctation of the aorta, with the narrowest diameter being 6 mm (Figure 1A). The blood pressure of the ascending aorta and descending aorta were 115/72 mmHg and 93/66 mmHg, respectively (Table 1). The left external iliac artery was totally occluded because of previous catheterization. After a 9 French, 65-cm-long sheath (Super Arrow-Flex; Arrow International Inc., Reading, PA, USA) was advanced into the aorta through the right femoral artery, a 36-mm-long stent (Intrastent DoubleStrut LD stent; Intratherapeutics Inc., St. Paul, MN, USA) was deployed by a 16-mm-diameter, 4-cm-long balloon (Boston Scientific Medi-tech, Natick, MA, USA) (Figure 1B). The final aortography showed that the coarctation was fully dilated (Figure 1C). The systolic pressure gradient decreased from 22 mmHg to 0 mmHg. There was no hematoma or other complications. Annual follow-up for 6 years showed normal blood pressure, no exercise intolerance, and no recoarctation.

Table 1 The aortic pressure and diameters before and after the stent implantation

	Pre-stent	Post-stent
AAO pressure (mmHg)	115/72	147/97
DAO pressure (mmHg)	93/66	147/97
Systolic pressure gradient of COA (mmHg)	22	0
COA diameter (mm)	6	16
DAO diameter at the diaphragm level (mm)	13.39	13.39
The ratio of the diameter of COA to DAO	0.45	1.19

AAO = ascending aorta; COA = coarctation of aorta; DAO = descending aorta.

3. Discussion

More and more evidence shows that the choice of treatment for coarctation of the aorta depends on the patient's age. For a patient younger than 1 year, balloon angioplasty is only palliative. The rate of recoarctation after balloon angioplasty has been reported to be more than 50%.[3] Although surgical correction carries certain risks, it is usually recommended in infancy because it has a good result in increasing the diameter of coarctation of the aorta and has a low reintervention rate. For a patient older than 1 year, balloon angioplasty has a good immediate result, but the rates of recoarctation and aneurysm formation were around 26% and 34%, respectively, in a recent report.[4] Just like our patient, he had received balloon angioplasty twice, but restenosis occurred both times. Endovascular stent can reduce the recoil of the vascular wall and avoid overdilation to reduce the rate of aneurysm formation.[5,6] Aneurysm formation after stenting is around 8% in an intermediate follow-up result.[7] Stent implantation for children and adults had almost 100% success rate to reduce the gradient to less than 20 mmHg or increase the ratio of the diameter of coarctation to the descending aorta to more than 0.8.[7] The post-stent coarctation systolic gradient of less than 10 mmHg was also noted in around 92% of patients.[7] In this patient, the systolic pressure gradient across the coarctation decreased from 22 mmHg to 0 mmHg, and the ratio of the diameter of coarctation to the descending aorta increased from 0.45 to 1.19. The result was comparable to that of surgery. The success rate of surgical repair is 100%, but the complication rate was 50% in a recent study.[4] Furthermore, endovascular stent has the lowest morbidity risks in a meta-analysis study compared with surgery or balloon angioplasty.[8] Covered stents, especially Cheatham-Platinum covered stents, are useful in adults with coarctation, especially with complex lesions, such as patent ductus arteriosus, or near aortic arch interruptions and significant arch tortuosity.[9,10] The covered Cheatham-Platinum stents are limited to patients who are nearly fully grown because redilation can only be up to 25 mm, and at diameters of up to 22 mm, vessels can shorten by one-eighth of their initial length.[10] Although the

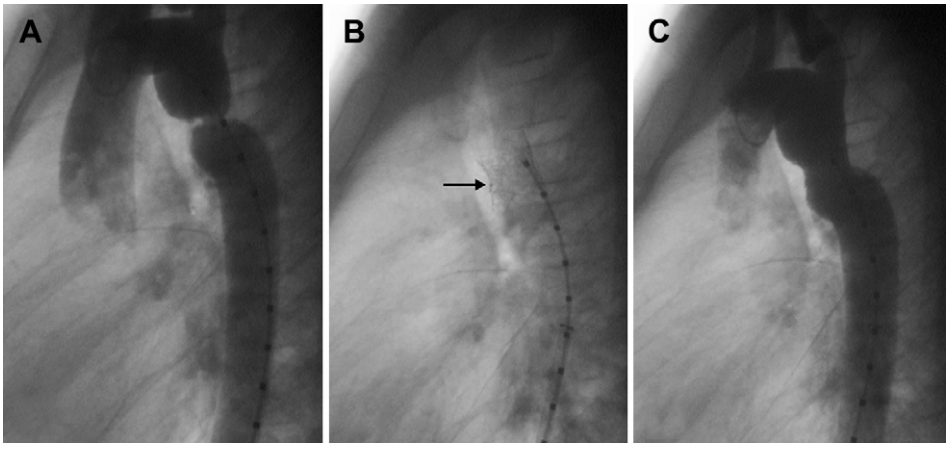

Figure 1 (A) Aortography in lateral projection shows the severe discrete coarctation of the aorta. (B) The stent is sitting in a good position. (C) Final aortography shows that the coarctation is fully dilated.

patient's age, weight, location of coarctation, and native versus recurrent coarctation do not affect the successful outcome, endovascular stenting is not suitable for a rapidly growing child.[11] It is usually recommended for a patient older than 10 years or weighing more than 35 kg.[11] From the reviewed literature, endovascular stent is a treatment of choice for patients older than 10 years or weighing more than 35 kg.

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